CHAPTER 9

AEROMEDICAL INFORMATION

INTRODUCTION

A pilot is responsible for maintaining an awareness of the mental and physical standards required for operating an aircraft. This chapter provides information on medical certification and on aeromedical factors with which pilots must be concerned in their flying activities.

OBTAINING A MEDICAL CERTIFICATE

All pilots except those with a recreational pilot certificate or those flying gliders or free air balloons must possess a valid medical certificate in order to exercise the privileges of their airman certificates. If a medical certificate is not required, then pilots must certify that they have no known medical condition which would prohibit them from exercising the privileges of the certificate.

The periodic medical examinations required for medical certification are conducted by designated aviation medical examiners, who are physicians with a special interest in aviation safety and training in aviation medicine.

The standards for medical certification are contained in 14 CFR part 67. The requirements for obtaining medical certification are contained in 14 CFR part 61.

Prior to beginning flight training, a flight instructor should interview the prospective student about any health conditions and determine the ultimate goal of the student as a pilot. Good advice would be to obtain the class of medical certificate required before beginning flight training. Finding out immediately whether the student is medically qualified could save time and money.

Students who have physical limitations such as impaired vision, loss of a limb, hearing impairment, etc., may possibly be issued a medical certificate valid for "Student Pilot Privileges Only." This kind of medical certificate will allow them to continue flight training and to prepare for the pilot certification practical test. During pilot training, flight instructors should ensure that students can perform all required tasks safely to the required standards. Special devices may be necessary to allow students to manipulate the flight controls. If unable to perform certain tasks, the student may have a limitation placed on his/her pilot certificate. For example, impaired hearing would require the limitation "Not Valid for Flight Requiring the Use of Radio." Another limitation may allow the pilot to only operate a certain make and model airplane such as one without rudder pedals.

When students with a physical limitation meet all of the knowledge, experience, and proficiency requirements, they should write a letter to the FAA Regional Flight Surgeon requesting a special medical flight test. The student's medical file is reviewed and a Letter of Authorization or Denial is issued to the student. If the test is authorized, the student will be instructed to contact the nearest Flight Standards District Office (FSDO) and request a test. After showing that they can operate the airplane with the normal level of safety, they are issued a waiver or statement of demonstrated ability (SODA). This waiver or SODA is valid as long as their physical impairment does not worsen. Additional information can be obtained on this subject at the local FSDO. Unless otherwise limited, medical certificates are valid for a period of time specified in 14 CFR part 61.

The medical certificate for a private pilot is a third class. It is valid for 3 years for those who are under 40 years of age and then it is valid for 2 years.

A commercial pilot certificate requires at least a second class medical certificate which is valid for 1 year.

An airline transport pilot certificate requires a first class medical certificate which is valid for 6 months.

A pilot should note that the class of medical required applies only when exercising the privilege of the certificate for which it was required. This being the case, a first class certificate would be valid for 1 year if exercising the privileges of a commercial certificate and 2 or 3 years, as appropriate for exercising the privileges of a private certificate. The same applies for a second class certificate.

HEALTH FACTORS AFFECTING PILOT PERFORMANCE

Minor illnesses, especially those requiring medications can seriously degrade pilot performance. Even many normal occurrences of everyday living such as fatigue, stress, allergies, etc., can affect pilot performance. The safest decision when feeling a little under par is not to fly. If unsure, consult a Medical Examiner.

Regulations prohibit pilots from performing crewmember duties while using any medication that affects the pilot's ability to operate an aircraft safely. Over-the-counter medications may also have side-effects to the point of causing dangerous reactions. Pain relievers can cover up or mask an illness that could impair one's judgment or cause dizziness, nausea, or hyperventilation. Some medications for colds and flu may cause dizziness, blurred vision, or impairment of coordination. Bowel preparations can cause unexpected bowel activities as well as drowsiness, depression, and blurred vision. Some appetite suppressants cause excessive stimulation, dizziness, and headaches. The result of taking sleeping aids is self-explanatory.

Caffeine may appear to wake a person up, but too much can cause excessive stimulation, tremors, and even palpitations. Mixing some of these can cause unexpected results.

The Aeronautical Information Manual (AIM) also includes a discussion on pilot aeromedical factors.

Alcohol

There is only one safe rule to follow with respect to flying and the consumption of alcohol: DON'T. Alcohol is metabolized at a fixed rate by the human body. This rate is not altered by the use of coffee or other popular so called remedies.

Alcohol is a factor in a number of fatal general aviation accidents. In spite of the high fatality rate, some pilots are not impressed and are under the delusion that flying after a few drinks is no more dangerous then driving under the same conditions.

We must accept two simple facts. First, flying an airplane is more complex than the two dimensional demands of driving an automobile. Second, altitude multiplies the effects of alcohol on the body.

For all practical purposes, only the brain gets "drunk." When a person drinks, the alcohol immediately begins to pass from the stomach to the bloodstream. Two ounces of bourbon will be absorbed by the bloodstream in 10 minutes, 4 ounces in 30 minutes. Alcohol is carried to all parts of the body with varying effects, but the brain is most affected. Alcohol numbs the brain in the area where our thinking takes place, then proceeds to the area that controls body movement. Coordination is affected, eyes fail to focus, and hands lose their dexterity.

14 CFR part 91 prohibits pilots from performing crewmember duties within 8 hours after drinking any alcoholic beverage or being under the influence of alcohol. The best rule is to allow at least 12 to 24 hours between "bottle and throttle" depending on the amount of alcohol consumed.

Fatigue

Fatigue is a normal occurrence of everyday living. Fatigue is feeling tired after long periods of physical or mental strain. Some common causes are strong emotional pressure, heavy mental workload, monotony, lack of sleep, etc. Alertness and coordination suffer while performance and judgment become impaired.

Anxiety

Anxiety is a state of uneasiness arising from fear. It slows down the learning process. Reactions vary from a person who reacts to "do something even if it's wrong" to a person who "freezes" and refuses to act. Others may do things without rational thought or reason.

Anxiety can be countered by learning to cope with fear and realizing that fear is a normal reaction. Anxiety for student pilots is often associated with performing certain flight maneuvers. Instructors should introduce flight maneuvers with care, so that students know what to expect, and what their reactions should be. Education is the best way to cope with fear of the unknown.

Stress

Stress is defined as the body's response to demands made upon it by everyday living. In flying, these stresses consist of physical, physiological, and psychological stress. Physical stress consists of such things as cold, noise, or lack of oxygen. Physiological stress consists of fatigue, poor health, lack of food, or sleep. Psychological stress consists of emotional factors such as illness in the family, personal problems, or a high mental workload during an inflight situation.

Anything perceived as a threat causes the body to gather its resources to cope with the situation. The adrenal gland produces hormones which prepare the body to meet the threat. The heart rate quickens, certain blood vessels constrict and divert blood to the organs which will need it, and other changes take place. Normal individuals begin to respond rapidly within the limits of their experience and training. Many responses are automatic, which points to the need for proper training in all situations. The affected individual thinks and acts rapidly, often leading to stress overload. The pilot begins to use poor judgment which often leads to poor decision making. This leads to tunnel vision or concentrating on the perceived threat rather than dealing with all elements of the situation.

In student training, the best way to deal with severe stress is to terminate the flight period, return to the airport, and deal with the problem tomorrow. In other situations, pilots need to recognize the symptoms of stress or stress overload and learn how to manage it. A good physical fitness program, proper rest, and regular meals are a good beginning. The pilot should know his/her capabilities and limitations and operate within them. Avoid stressful situations such as pressing the weather or overflying that planned fuel stop.

Emotion

Being emotionally upset has the same effect on a pilot as extreme stress or fatigue. There are many causes such as divorce, loss of job, death in the family, financial trouble, etc. It causes anger, depression, and anxiety. This emotion affects judgment and alertness to a dangerous degree. Don't fly when emotionally upset.

Tobacco

At ground level, smoking reduces a person's visual acuity and dark adaptation to the extent of that encountered in flight at 8,000 feet MSL. Smoking at 10,000 feet MSL produces hypoxia equivalent to 14,000 feet. The absorption of nicotine into the blood causes a corresponding drop in blood oxygen saturation and will lead to hypoxia. Smoking causes specific physiological debilitation and diseases that are medically disqualifying for pilots. Smoke also damages gyroscopic instruments in those aircraft drawing flight deck air through the instruments, and fouls the outflow valves in pressurized aircraft.

Environmental Factors Which Affect Pilot Performance

Human beings, who are designed for living on Earth, must now learn to survive in a slightly different environment. The effects of a deficiency of oxygen, changing pressures on the ears and sinuses, spatial disorientation, illusions in flight, and visual requirements require procedures and aids not commonly used on the surface.

Hypoxia

Hypoxia is a deficiency of oxygen which impairs the brain functions and other organs. As we gain altitude, the atmosphere decreases in pressure. Although the air still is 21 percent oxygen, the amount of oxygen present also is decreased as the air pressure is decreased.

Night vision begins to deteriorate at about 5,000 feet MSL. From about 12,000 to 15,000 feet MSL, judgment, memory, alertness, coordination, and ability to make calculations are impaired. Some pilots might feel dizzy or drowsy. A sense of well-being (euphoria) or belligerence can occur. A pilot's performance can seriously deteriorate within 15 minutes at 15,000 feet MSL. Above 15,000 feet MSL, the periphery of the visual field grays out to a point where only central vision remains (tunnel vision). Fingernails and lips turn blue. The ability to take corrective and protective action is lost in 20 to 30 minutes at 18, 000 feet and 5 to 12 minutes at 20,000 feet MSL, followed soon thereafter by unconsciousness.

The effect of hypoxia occurs at lower altitudes with the use of some medication, smoking, alcohol, emotional stress, etc. The worst part is the fact that hypoxia is very difficult to recognize because of the gradual dulling of the senses. Since symptoms of hypoxia do not vary in an individual, the ability to recognize hypoxia can be greatly improved by experiencing and witnessing the effects of it during an altitude chamber "flight." The FAA provides this opportunity through aviation physiology training, which is conducted at the FAA Civil Aeromedical Institute (CAMI) and at many military facilities across the United States. To attend the Physiological Training Program at CAMI telephone (405) 954-6212 or write:

Mike Monroney Aeronautical Center
Airman Education Program Branch
AAM- 420 CAMI
P.O. Box 25082
Oklahoma City, OK 73125

Hyperventilation in Flight

Hyperventilation, or an abnormal increase in the volume of air breathed in and out of the lungs, can occur subconsciously when a stressful situation is encountered in flight. As hyperventilation "blows off" excessive carbon dioxide from the body, a pilot can experience symptoms of light-headedness, suffocation, drowsiness, tingling in the extremities, and coolness – and react to them with even greater hyperventilation. Incapacitation can eventually result from incoordination, disorientation, and painful muscle spasms. Finally, unconsciousness can occur.

The symptoms of hyperventilation subside within a few minutes after the rate and depth of breathing are consciously brought back under control. The buildup of carbon dioxide in the body can be hastened by controlled breathing in and out of a paper bag held over the nose and mouth.

Early symptoms of hyperventilation and hypoxia can occur at the same time. Therefore, if a pilot is using an oxygen system when symptoms are experienced, the oxygen regulator should immediately be set to deliver 100 percent oxygen, and then the system checked to assure that it has been functioning effectively before giving attention to rate and depth of breathing.

Middle Ear Discomfort or Pain

This is one environmental phenomenon that pilots and passengers are aware of immediately. Any discomfort can be relieved, and is not harmful if the eustachian tube is periodically opened to equalize pressure on each side of the ear drum. This can be accomplished by swallowing, yawning, tensing muscles in the throat; or if these do not work, by a combination of closing the mouth, pinching the nose closed, and attempting to blow through the nostrils.

Flying with any upper respiratory infection, such as a cold or sore throat, or a nasal allergic condition can produce enough congestion around the eustachian tube to make equalization difficult. An ear block produces severe ear pain and loss of hearing that can last from several hours to several days. Rupture of the ear drum can occur in flight or after landing. Fluid can accumulate in the middle ear and become infected. Adequate protection is usually not provided by decongestant sprays or drops to reduce congestion around the eustachian tubes. Oral decongestants have side effects that can significantly impair pilot performance.

During ascent and descent, air pressure in the sinuses equalizes with the aircraft cabin pressure through small openings that connect the sinuses to the nasal passages. Either an upper respiratory infection, such as a cold or sinusitis, or a nasal allergic condition can produce enough congestion around an opening to slow equalization. The difference in pressure between the sinus and cabin increases, and eventually plugs the opening. As with the ear block, the only solution is not to fly with upper respiratory problems.

Spatial Disorientation and Illusions in Flight

Many different illusions can be experienced in flight. Some can lead to spatial disorientation. Others can lead to landing errors. Illusions rank among the most common factors cited as contributing to fatal aircraft accidents.

Various complex motions and forces and certain visual scenes encountered in flight can create illusions of motion and position. Spatial disorientation from these illusions can be prevented only by visual reference to reliable, fixed points on the ground or to flight instruments.

An abrupt correction of a banked attitude, which has been entered too slowly to stimulate the motion sensing system in the inner ear (the leans) can create the illusion of banking in the opposite direction. The disoriented pilot will roll the aircraft back into its original dangerous attitude or, if level flight is maintained, will feel compelled to lean in the perceived vertical plane until this illusion subsides. Any time an attitude is maintained for an extended period, the ears will try to deceive the pilot into believing that the aircraft is in straight-and-level flight.

An abrupt head movement in a prolonged constant-rate turn that has ceased stimulating the motion sensing system can create the illusion of rotation or movement in an entirely different axis. An abrupt change from climb to straight-and-level flight can create the illusion of tumbling backwards, while an abrupt upward vertical acceleration, usually by an updraft, can create the illusion of being in a climb. The most overwhelming of all illusions in flight may be prevented by not making sudden, extreme head movements, particularly while making prolonged constant-rate turns under instrument flight rule (IFR) conditions.

Sloping cloud formations, an obscured horizon, a dark scene spread with ground lights and stars, and certain geometric patterns of ground light can create

illusions of not being aligned correctly with the actual horizon. In the dark, a static light will appear to move about when stared at for a period of time. The disoriented pilot will lose control of the aircraft in attempting to align it with the light.

Various surface features and atmospheric conditions encountered in landing can create illusions of incorrect height above and distance from the runway threshold. Landing errors from these illusions can be prevented by anticipating them during approaches, aerial visual inspection of unfamiliar airports before landing, using electronic glide slope or VASI systems when available, and maintaining proficiency in landing procedures.

A narrower-than-usual runway can create the illusion that the aircraft is at a higher altitude than it actually is. A wider-than-usual runway can have the opposite effect, with the risk of leveling out high and landing hard or overshooting the runway.

An upsloping runway, upsloping terrain, or both, can create the illusion the aircraft is at a higher altitude than it actually is. A downsloping runway, downsloping approach terrain, or both, can have the opposite effect.

An absence of ground features, as when landing over water, darkened areas, and terrain made featureless by snow, can create the illusion that the aircraft is at a higher altitude than it actually is.

Rain on the windscreen can create the illusion of greater height, and atmospheric haze can give the illusion of being at a greater distance from the runway.

Lights along a straight path, such as a road, and even lights on moving trains can be mistaken for runway and approach lights. Bright runway and approach lighting systems, especially where few lights illuminate the surrounding terrain, may create the illusion of less distance to the runway.

Motion Sickness

Anyone who has experienced motion sickness knows how unpleasant it can be. Most important, it can jeopardize the pilots' flying efficiency at critical times when their skills are required the most. Student pilots sometimes experience motion sickness during early flight training. The flight instructor will usually recognize the onset of motion sickness and terminate the flight lesson. With increasing experience, the problem usually goes away.

Motion sickness is caused by continued stimulation of the inner ear which controls the sense of balance. The symptoms are progressive. Pilots may experience loss of appetite, saliva collecting in the mouth, perspiration, nausea, and possible disorientation. The head aches and there may be a tendency to vomit. If allowed to become severe enough, the pilot may become incapacitated.

Pilots who are susceptible to motion sickness should not take the preventive drugs available over the counter or by prescription. These drugs can cause drowsiness, depression of brain function, and loss of motor skills.

When suffering from motion sickness, open the air vents, loosen clothing, and use oxygen if available. Try to keep the eyes focused on a point outside the airplane and avoid unnecessary head movements. Terminate the flight as soon as possible.

Carbon Monoxide Poisoning

Carbon monoxide is a colorless, odorless, and tasteless gas contained in exhaust fumes. When breathed even in minute quantities over a period of time, it can significantly reduce the ability of the blood to carry oxygen. Consequently, effects of hypoxia occur.

Most heaters in light aircraft work by air flowing over the engine exhaust manifold. Use of these heaters while exhaust fumes are escaping though exhaust manifold cracks and seals are responsible every year for several nonfatal and fatal aircraft accidents from carbon monoxide poisoning.

A pilot who detects the odor of exhaust or experiences symptoms of headache, drowsiness, or dizziness while using the heater should suspect carbon monoxide poisoning, and immediately shut off the heater and open air vents. If symptoms are severe, or continue after landing, medical treatment should be sought.

Decompression Sickness After Scuba Diving

A pilot or passenger who intends to fly after scuba diving should allow the body sufficient time to rid itself of excess nitrogen absorbed during diving. If not, decompression sickness due to evolved gas can occur during exposure to altitude and create a serious inflight emergency.

The recommended waiting time before going to flight altitudes up to 8,000 feet MSL is at least 2 hours after diving and at least 24 hours after diving which has required controlled ascent. The waiting time before going to flight altitudes above 8,000 feet MSL should be at least 24 hours after any scuba dive. For more detailed information, contact your Medical Examiner.

Vision in Flight

Of the body senses, vision is the most important for safe flight. Major factors that determine how effectively vision can be used are the level of illumination and the technique of scanning the sky for other aircraft.

Under conditions of dim illumination, small print and colors on aeronautical charts and aircraft instruments become unreadable unless adequate cockpit lighting is available. Moreover, another aircraft must be much closer to be seen unless its navigation lights are on.

In darkness, vision becomes more sensitive to light, a process called dark adaptation. Although exposure to total darkness for at least 30 minutes is required for complete dark adaptation, the pilot can achieve a moderate degree of dark adaptation within 20 minutes under dim red cockpit lighting. Since red light severely distorts colors, especially on aeronautical charts, and can cause serious difficulty in focusing the eyes on objects inside the aircraft, its use is advisable only where optimum outside night vision capability is necessary. Even so, white cockpit lighting must be available when needed for map and instrument reading, especially under IFR conditions. Dark adaptation is impaired by exposure to cabin pressure altitudes above 5,000 feet MSL, carbon monoxide inhaled in smoking, from exhaust fumes, deficiency of Vitamin A in the diet, and by prolonged exposure to bright sunlight. The pilot should close one eye when using a light to preserve some degree of night vision.

Excessive illumination, especially from light reflected off the canopy, surfaces inside the aircraft, clouds, water, snow, and desert terrain, can produce glare, which may cause uncomfortable squinting, watering of the eyes, and even temporary blindness. Sunglasses for protection from glare should absorb at least 85 percent of visible light and all colors equally, with negligible image distortion from refractive and prismatic errors.